

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL  
EASTERN ZONE BENCH, KOLKATA

IN  
Original Application No.70/2024/EZ  
(Earlier OA 160/2024/PB)

In the Matter of:-

News Item titled "Rising sea, shrinking sands erode vibrancy of Ganga Sagar  
Mela" appearing in the Hindu dated 15.01.2024

.....Applicant(s)

Versus

West Bengal State Coastal Zone Management  
Authority & Ors.

..... Respondent(s)

INDEX

Sl. No.	Particulars	Page No.
1.	Affidavit on behalf of Respondents No. 2 (NCSCM)	1 to 4
2.	Report (Annexure - R-1)	5 to 18

Filed by:-

*Ashok Prasad*

ASHOK PRASAD, ADVOCATE  
COUNSEL FOR NCSCM

Dated: 30/08/2024, 2024  
Place: Kolkata



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Original Application No.70/2024/EZ  
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COUNTER AFFIDAVIT ON BEHALF OF M/s. NATIONAL CENTRE FOR  
SUSTAINABLE COASTAL MANAGEMENT (RESPONDENT No. 2)

I, Dr. Purvaja Ramachandran, Daughter of Mr. G V Ramachandran, aged about 57 years, currently working as Director in the National Centre for Sustainable Coastal Management (NCSCM), Ministry of Environment, Forest and Climate Change, having office at Anna University Campus Chennai 600 025 do hereby solemnly affirm and state as follows:



*Purvaji*  
Director

National Centre for Sustainable Coastal Management  
Ministry of Environment, Forest and Climate Change  
Government of India, Anna University Campus  
Chennai - 600 025, India

1. I am working as Director in the National Centre for Sustainable Coastal Management (NCSCM), Ministry of Environment, Forest and Climate Change, having office at Anna University Campus, Chennai respondent and I am conversant with the facts of the case as borne out from the records. I am swearing this affidavit on behalf of the National Centre for Sustainable Coastal Management (NCSCM), Respondent No. 2, as I am duly authorized to do so.
2. It is submitted at the very outset that the Respondent No. 2 denies each averment and/or submission made in the application which is contrary to and inconsistent with the averments made and facts stated in the present reply. It is submitted that the nothing stated in the application may be deemed to have been admitted by the Respondent No. 2 unless and until the same is expressly admitted in the present reply.
3. That for the compliance of the Hon'ble Tribunal, the National Centre for Sustainable Coastal management (NCSCM) (Respondent No. 2), prepare a report on titled **"Rising sea, shrinking sands erode vibrancy of Ganga Sagar Mela"** .  
**A copy of the Report is annexed herewith and marked as Annexure R-1.**
4. The answering respondent seeks liberty and reserves the right to file a detailed affidavit, as and when required and if directed by this Hon'ble Tribunal. The Answering Respondent denies each and every allegation contained in the Application, except as specifically admitted herein.



Director  
National Centre for Sustainable Coastal Management  
Ministry of Environment, Forest and Climate Change  
Government of India, Anna University Campus  
Chennai - 600 025. India

- 5. The answering respondent reserves the right to file the additional Information before the Hon'ble Tribunal till Pendente - lite.
- 6. In view of the aforementioned facts and circumstances, this Hon'ble Tribunal may kindly be pleased to pass appropriate order(s).

*Purvasaji*  
**DEPONENT**  
 Director

National Centre for Sustainable Coastal Management  
 Ministry of Environment, Forest and Climate Change  
 Government of India, Anna University Campus

**VERIFICATION**

I, Dr. Purvaja Ramachandran, the above named deponent do hereby verify that the contents of the above affidavit are true and correct on the basis of official record maintained by the Respondent No. 2 in daily course of its business, no part of it is false and nothing material has been concealed there from.

Signed and verified on this      Day of August, 2024 at Chennai.



Identified by Me  
 Advocate

*A. Senthil Kumar*  
**A. SENTHIL KUMAR, B.A., B.L.,**  
**ADVOCATE & NOTARY PUBLIC**  
 Government of India  
 No.27/B, Kamaraj Road, Tindivanam - 605 001  
 Cell: 90942 56442  
 19/08/2024

*Purvasaji*  
**DEPONENT**  
 Director

National Centre for Sustainable Coastal Management  
 Ministry of Environment, Forest and Climate Change  
 Government of India, Anna University Campus  
 Chennai - 600 025, India

## Annexure R-1

**Rising sea, shrinking sands erode vibrancy of Ganga Sagar Mela**

West Bengal is the eastern most coastal state in India bordering the Bay of Bengal. The state borders Odisha in the southwest and Bihar and Jharkhand to the west. It shares a border with Bangladesh on the east and with Assam, Bhutan, Sikkim and Nepal to the north. The southern boundary of the state is the Bay of Bengal. The world's largest delta formed by the Ganges and Brahmaputra rivers spread over the Bengal region includes nine districts of West Bengal comprising one third of the delta while the remaining two thirds is in Bangladesh. The Indian Sundarban is in the North and South 24-Parganas districts of West Bengal.

Sagar Island is connected to the mainland only through the sea route. In mid-January every year during Makar Sankranti, there is a huge congregation of pilgrims in Gangasagar at the southern tip of Sagar Island. This influx of pilgrims for the Gangasagar Mela is considered only second to the Kumbh Mela and at this time, there are considerable problems related to wastewater discharge, solid waste generation and disposal. Sagar Island has a perimeter of 71 km, covered mostly by revetment type concrete and earthen embankments. Gangasagar is the only beach in Sagar Island. Mangroves are present at the north-western and the south-eastern part of the island. Shoreline changes are prominent along the Coast of Sagar Island. Predominant areas of erosion along the Sagar Island include the eastern and southern stretches, particularly at Sibpur (Boatkhali). Accretion is observed at the mouth of Sikarpur creek. Cyclonic storm surges and tidal surges cause regular damage with the most recent being Cyclone Aila that made landfall close to Sagar Island. The population is predominantly rural with the major livelihood being agriculture followed by plantation (betel vines), fisheries and tourism.

The hazard line delineated by the MoEFCC through the Survey of India (Sol) and National NCSCM, taking into account tides, waves, sea level rise and shoreline changes has been used for identifying areas affected by long term extreme events. Analysis of the percentage of various risk categories for Sagar shows that major portion (63%) of the area within the hazard line of Sagar is categorized as 'High Risk'. The area at 'Very High Risk' is 18%, at 'Moderate Risk' is (17%) and at 'Low Risk' is 2%, indicating the severity of the risk to flooding and erosion along the coast of Sagar Island.

The remote geographical setting of Sagar Island and the associated limited connectivity, currently confined to access only by boat, is a major constraint to development. The topography of Sagar Island is largely flat, with very slight



slope variations which are primarily manmade – of canals and bunds. Because of the low-lying topography and location of Sagar Island, the coastal zone is susceptible to flooding events during cyclones up to even 6 m elevation (the highest point is 15 m). The island is located in the Ganges Delta, with River Hooghly on its western side, River Muriganga (which is a tributary of River Hooghly) on the east and Bay of Bengal on the southern end. This positioning exposes the island to waves, currents and tides, which causes certain stretches of the island to erode at a faster rate.

Erosion is a chronic problem along Sagar Island. Embankments have been built to protect the coast from erosion as well as for reclamation at many locations. Areas of high erosion along the Coast of Sagar Island are indicated in Figure 1. Sagar Island has a perimeter of 71 km, covered mostly by revetment type concrete and earthen embankments. Gangasagar is the only beach in Sagar Island. Mangroves are present at the northwest and the south eastern part of the island. Shoreline changes are prominent along the coast of West Bengal especially at a few locations along the Coast of Sagar Island. Predominant areas of erosion along the Sagar Island include the eastern and southern stretches, particularly at Sibpur (Boatkhali). Accretion is observed at the mouth of Sikarpur creek.

It is observed that almost the entire coast is protected by embankments. Despite the construction of embankments, it is evident from satellite data that erosion has been occurring on the seaward sides and gap areas between embankments. About 44.6% and 54.7% of the coast experiences erosion on long-term and short-term periods respectively. In the case of accretion, 38.7% in the long-term and 19.1% over short-term periods were observed. The remaining 16.7% of the coast is stable in the long-term and 26.2% in the short-term period. Analysis indicates high erosion in the short-term at Sagar Island and needs site-specific interventions to address this major concern.



### Erosion Map - Sagar Island

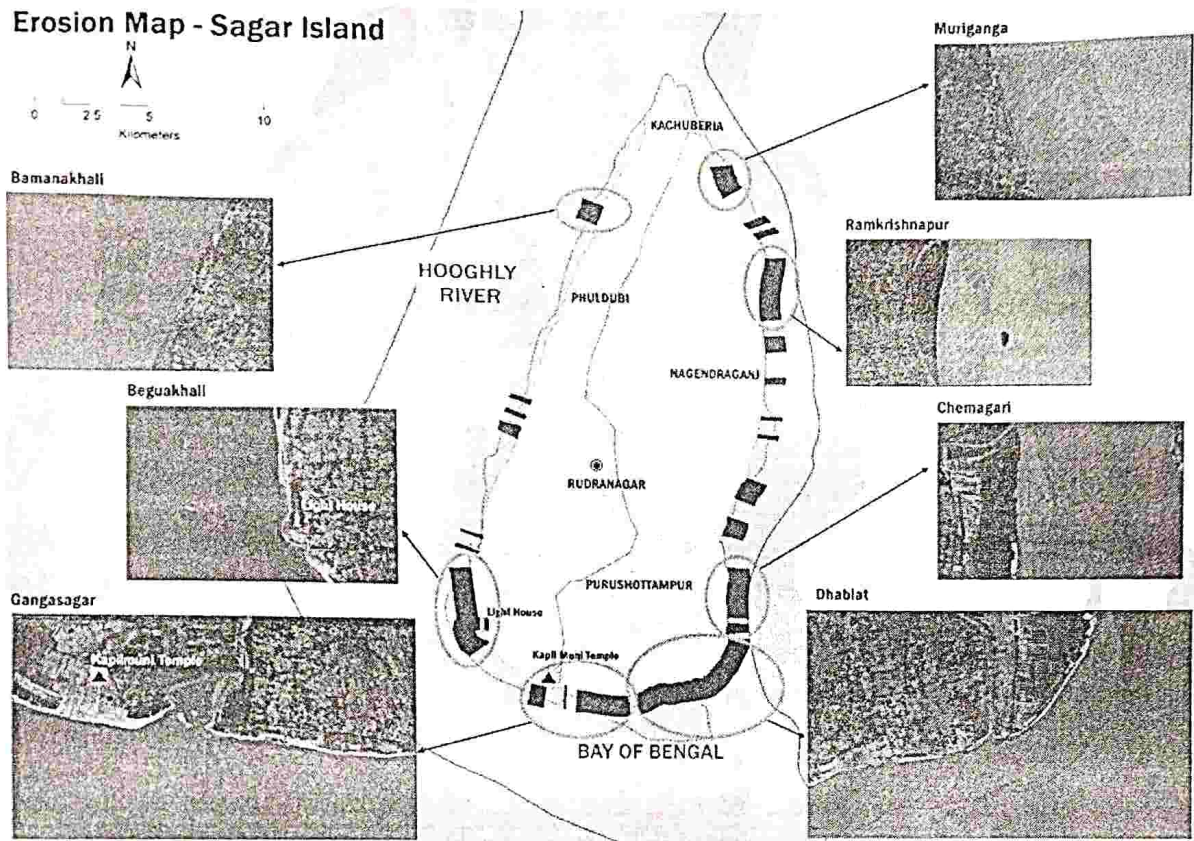
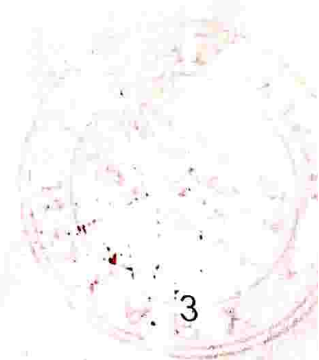


Figure 1: Major eroding stretches of Sagar Island on short-term time scales (2011-2018)

### Shoreline changes along the Coast of Sagar Island

Shoreline changes were estimated over two time periods (Figure 2), along Sagar Island: (a) long-term extending from 1975 to 2018 and (b) short-term from 2011 to 2018. Erosion is dominant along the southern part of the coast extending from Beguakhali to Chemagari. Figure 3 provides the percentage of shoreline change along Sagar Island, estimated for long-term (1975-2018) and short-term (2011-2018) using satellite data.



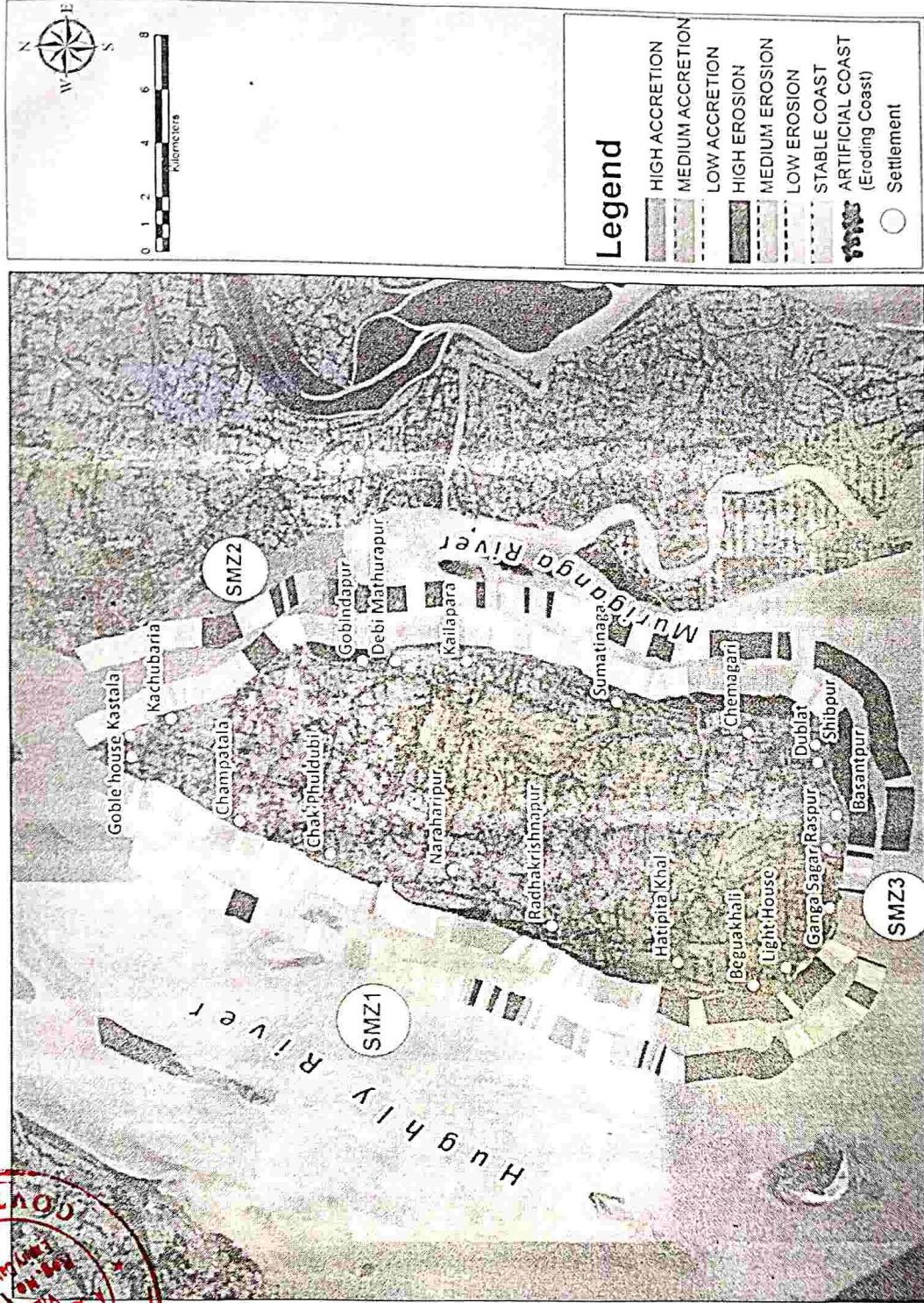


Figure 2: Long-term (Inner Layer) and short-term (Outer Layer) shoreline change status map for Sagar Island

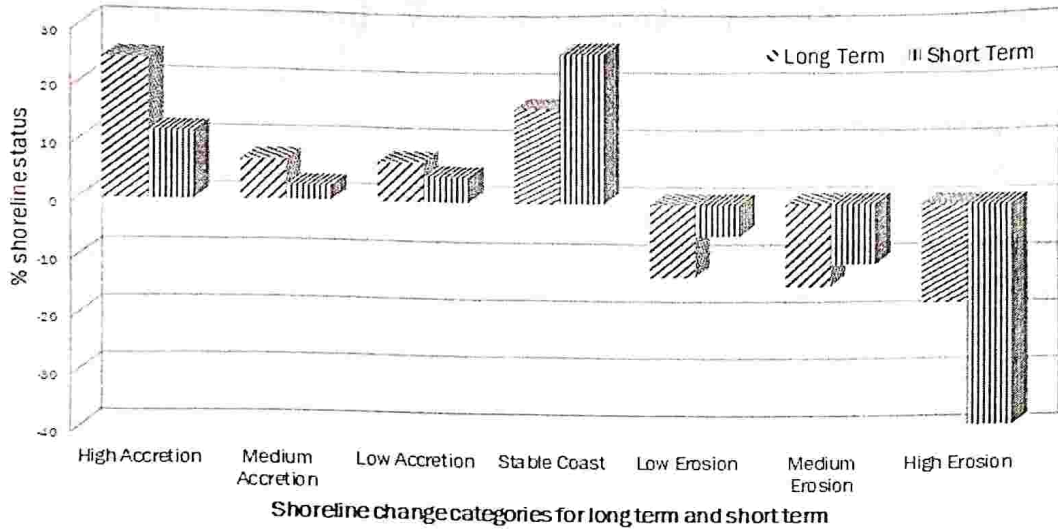


Figure 3: Shoreline change (%) in long-term and short-term along Sagar Island

It is observed that almost the entire coast is protected by embankments. Despite the construction of embankments, it is evident from satellite data that erosion has been occurring on the seaward sides and gap areas between embankments. About 44.6% and 54.7% of the coast experiences erosion on long-term and short-term periods respectively. In the case of accretion, 38.7% in the long-term and 19.1% over short-term periods were observed. The remaining 16.7% of the coast is stable in the long-term and 26.2% in the short-term period (Figure 3 and Tables 1 and 1).

Table 1: Percentage of long-term shoreline change classification

Long-term Classification	Shoreline Length (km)	% Erosion/ Accretion	Cumulative % Erosion/ Accretion
Length of Coastline	71.96		
High Erosion	12.44	17.29	
Medium Erosion	10.37	14.41	44.55
Low Erosion	9.25	12.85	16.72
Stable Coast	12.03	16.72	
High Accretion	17.63	24.50	
Medium Accretion	5.17	7.19	38.73
Low Accretion	5.07	7.04	

Table 2: Percentage of long-term shoreline change classification



Short-term Classification	Shoreline	Length (km)	% Erosion/ Accretion	Cumulative Erosion/ Accretion	%
Length of Coastline		72.29			
High Erosion		27.87	38.55		
Medium Erosion		7.64	10.57		
Low Erosion		4.01	5.55	54.67	
Stable Coast		18.97	26.24	26.24	
High Accretion		8.65	11.97		
Medium Accretion		1.89	2.61		
Low Accretion		3.25	4.50	19.08	

The analysis shows that erosion is high in the short-term (Figure 4) at Sagar Island. Analysis of changes from long-term to short-term periods reveal that accretion has changed to high erosion in sections of the coast shown as red circles *a* to *f* (Figure 5). Similarly, other areas show changes from accretion to low/medium erosion and low to medium and medium erosion to high erosion. They are depicted as yellow circles at *g* to *k* in Figure 5. Accretion has moderately decreased to 7% and a marginal increase in stable coast was observed (indicated in blue circles from *l* to *p*). Further, in areas south of *k*, though the length is insignificant, high erosion is noticed.

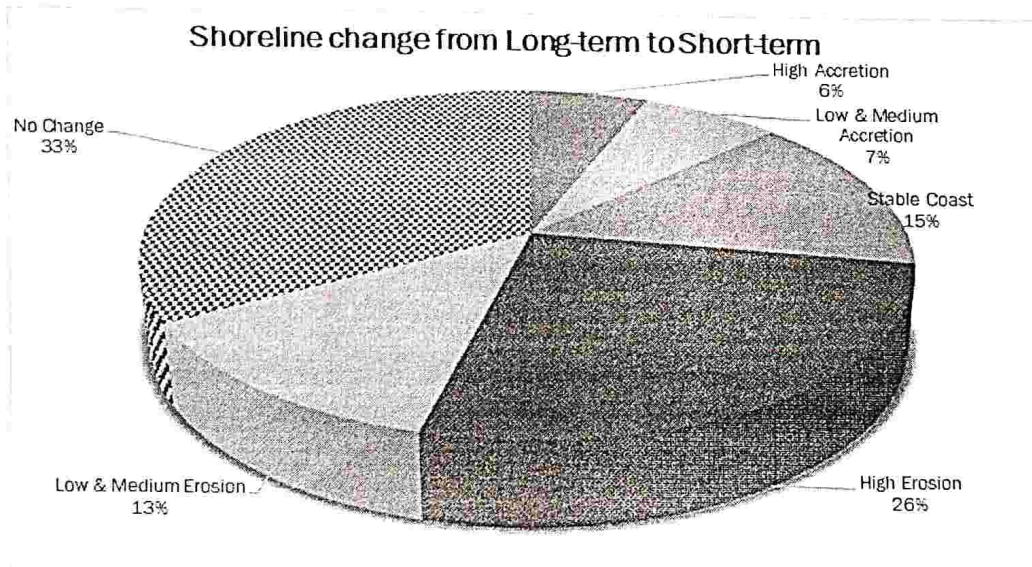


Figure 4: Shoreline change (%) from long-term to short-term along Sagar Island





The model simulation has been carried out to evaluate the impacts of detached offshore reefs with gap of 100m between the reefs at beach locations of Sagar Island to estimate the shoreline change. The detached reef structure facilitates to reduce the wave action and create strong currents to drive the sediments without trapping. It is useful for ease of movement of vessels/boats across the varying tidal conditions. These currents could also prove to be harmful so as to cause a sudden and strong drifts, which is unfavorable in a public area in the vicinity of a pilgrim site. However, it will not suitable at the Sibpur coast due to the strong tidal current than the wave action.

**Groyne Field at Kapil Muni Ashram**

Numerical models (Hydrodynamic, Spectral wave and Sediment Transport models) have been configured over the south of Sagar Island and simulated flow conditions, wave transformation and sediment transport with and without the shore protection measures during the monsoon period. Specially, model simulations have been conducted with groyne fields to evaluate the shore stability along the coast of Kapil Muni Ashram and Sibpur, South of Sagar Island. The series of T-shaped groynes implemented in the numerical model from the Low Tide Line and conducted the model simulations for a tidal cycle with the forcing of monsoon wind fields (>7 m/s). It was observed that the currents are diverted from the groyne field and increased the magnitude of current from 0.4 m/s to 0.6 m/s on the southeast region of south of Sagar Island (Figure 6). During flood tide period, the magnitude of current currents from 0.2 m/s to 0.4 m/s predicted behind the groyne field and could cause the removal of shore sediments and scouring at the groyne structure (Figure 7).

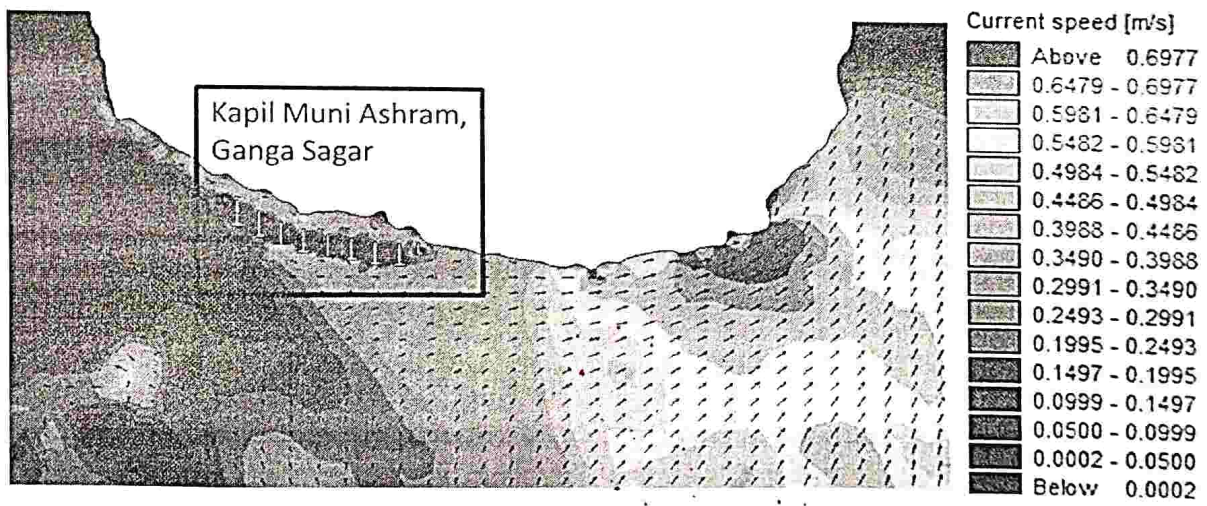


Figure 6: effect of groyne fields on flow environment during flood tide along the south of Sagar Island



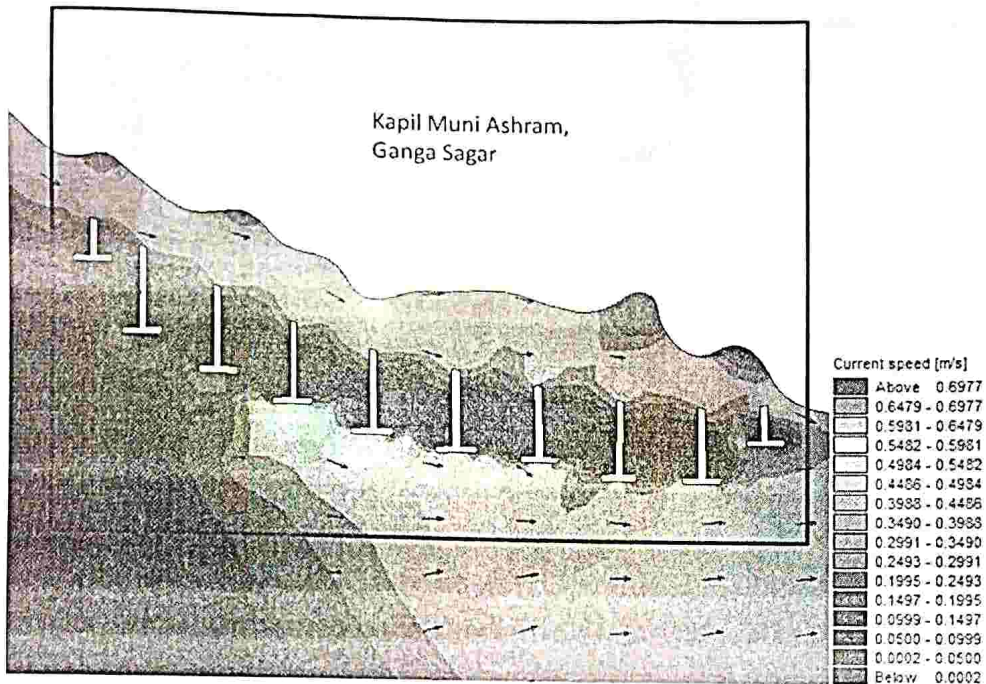


Figure 7: enlarged view of groyne fields on flow environment during flood tide along the southwest of Sagar Island

Spectral wave model simulations have been conducted to understand the wave transformation in and around the groyne field in the vicinity of Kapil Muni Ashram. The predictions clearly indicated the diffraction of the waves by varying the wave height from 0.8m to 1.04 m during the flood tide condition (Figure 8). It also revealed that the effect of wave was nullified when it approached the Coast of Sagar Island. However, the movement of sediments can be trapped by implemented groynes and cause sediment deficient in other regions.



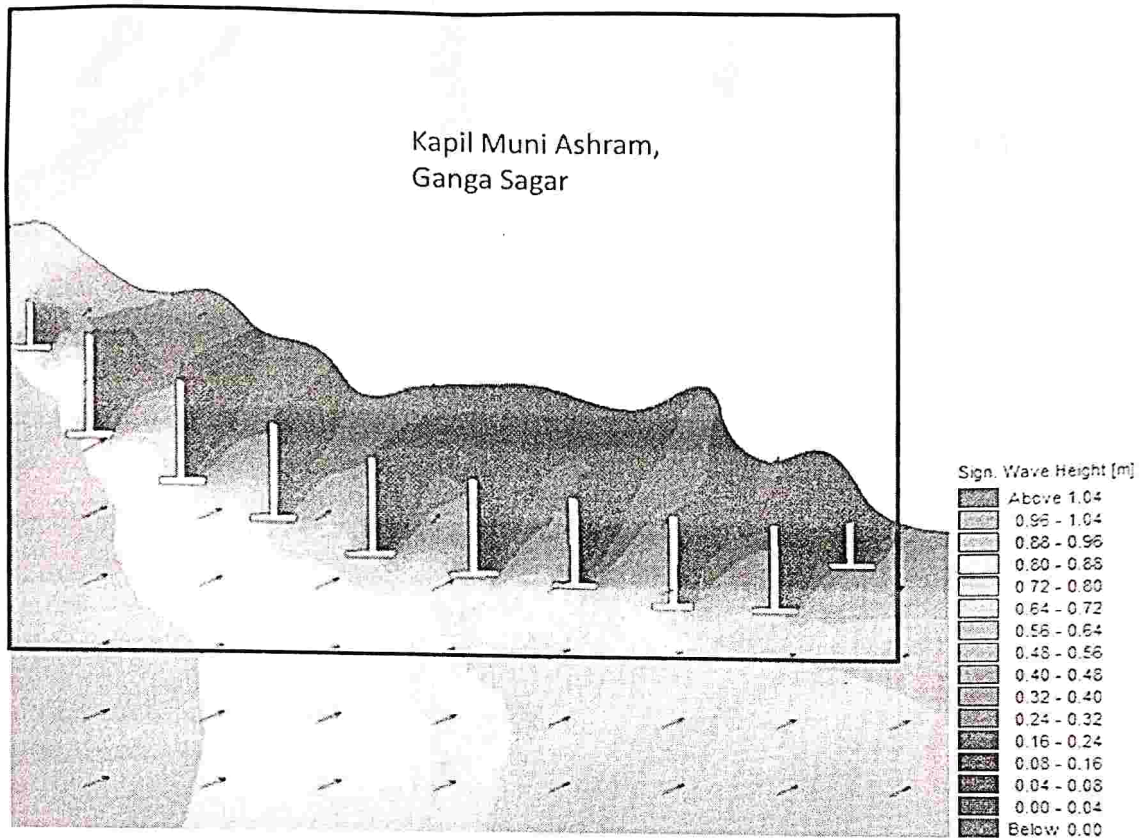


Figure 8: variation of significant wave height at the groyne field in the vicinity of Kapil Muni Ashram

Sediment transport model simulated the sediment transport rate and direction of the net sediment transport using the current and wave conditions with the groyne fields. The rate of sediment is predicted about  $1.461 \times 10^{-5}$  m<sup>3</sup>/s/m or 0.03873 kg/s/m in the direction of net sediment transport about 54.67°. During the low tide conditions, the rate of sediment transport is about  $3.709 \times 10^{-7}$  m<sup>3</sup>/s/m or  $9.829 \times 10^{-4}$  kg/s/m in the direction of net sediment transport is 116.13°. The sediment transport model predictions revealed that the high rate of sediment can be trapped at the groyne field during high tide compared low tide period. The sediment concentration profile has shown in the Figure 9 with reference to the mean velocity profile.



The Kármán-Prandtl equation used to compute the velocity profile is generally considered valid in the lower 10% or 20% of the water column.  
**It is used here over a greater range !**

z (m)	U (m/s)	SSC (kg/m <sup>3</sup> )
1.5	0.6868	2.276
1	0.6	2.771
0.7	0.5237	3.295
0.5	0.4516	3.88
0.3	0.3423	4.972
0.2	0.2555	6.054
0.1	0.1837	7.125
0.07	0.1591	7.533
0.05	0.136	7.939
0.03	0.1008	8.599
0.02	0.07285	9.161
0.01	0.02512	10.208

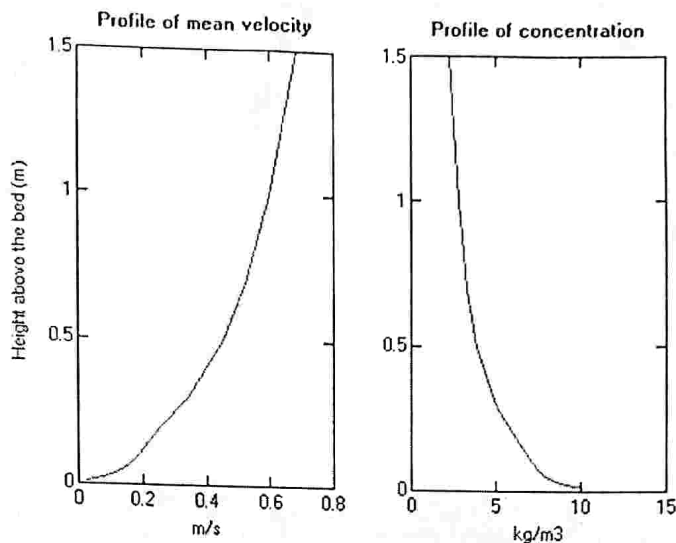


Figure 9: profiles of mean velocity and sediment concentrations in the vicinity of Kapil Muni Ashram during flood tide

The multiple T-shape groyne fields clearly showed that the reduction of wave heights from 1.04 m to 0.4 m ( $\approx 60\%$ ) and trapping of sediments during the flood tide period. However, groyne field affect the flow environment and transport of sediment. It could be caused sediment deficit in the other regions of the south Sagar Island.

**Recommendations by NCSCM**

The ICZM Plan was developed based on a framework – by preparing management sub-plans addressing the major concerns such as: coastal erosion (Shoreline Management), need for livelihood diversification (Livelihood Management), degradation of coastal ecosystems and habitats (Conservation Management), pollution due to sewage and solid wastes (Pollution Management), large number of tourists and inadequate tourism infrastructure (Tourism Management), and increased frequency and intensity of hazards (Disaster Management). Water Resources Management was considered as an additional sub-plan to address issues of future water security and sustainability. Baseline data and analysis of current land use, land cover and water resources have been carried out. For the first time, spatial planning of the marine area of West Bengal has been attempted, by preparing the Marine Spatial Plan, which includes components of Blue Economy.

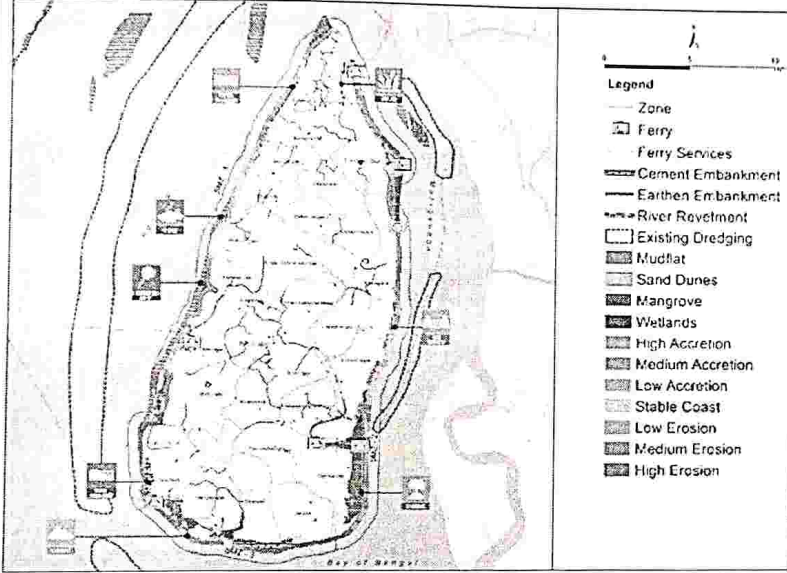
**Shoreline Management Plan Recommendations:**

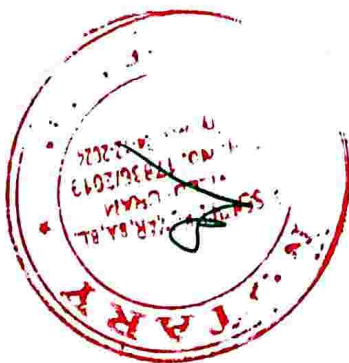
Through a comprehensive examination of shoreline change analysis, coastal processes, and numerical modeling, NCSCM has provided detailed intervention plans along the Sagar Island. Specifically, the Kapil Muni Ashramam stretch has been

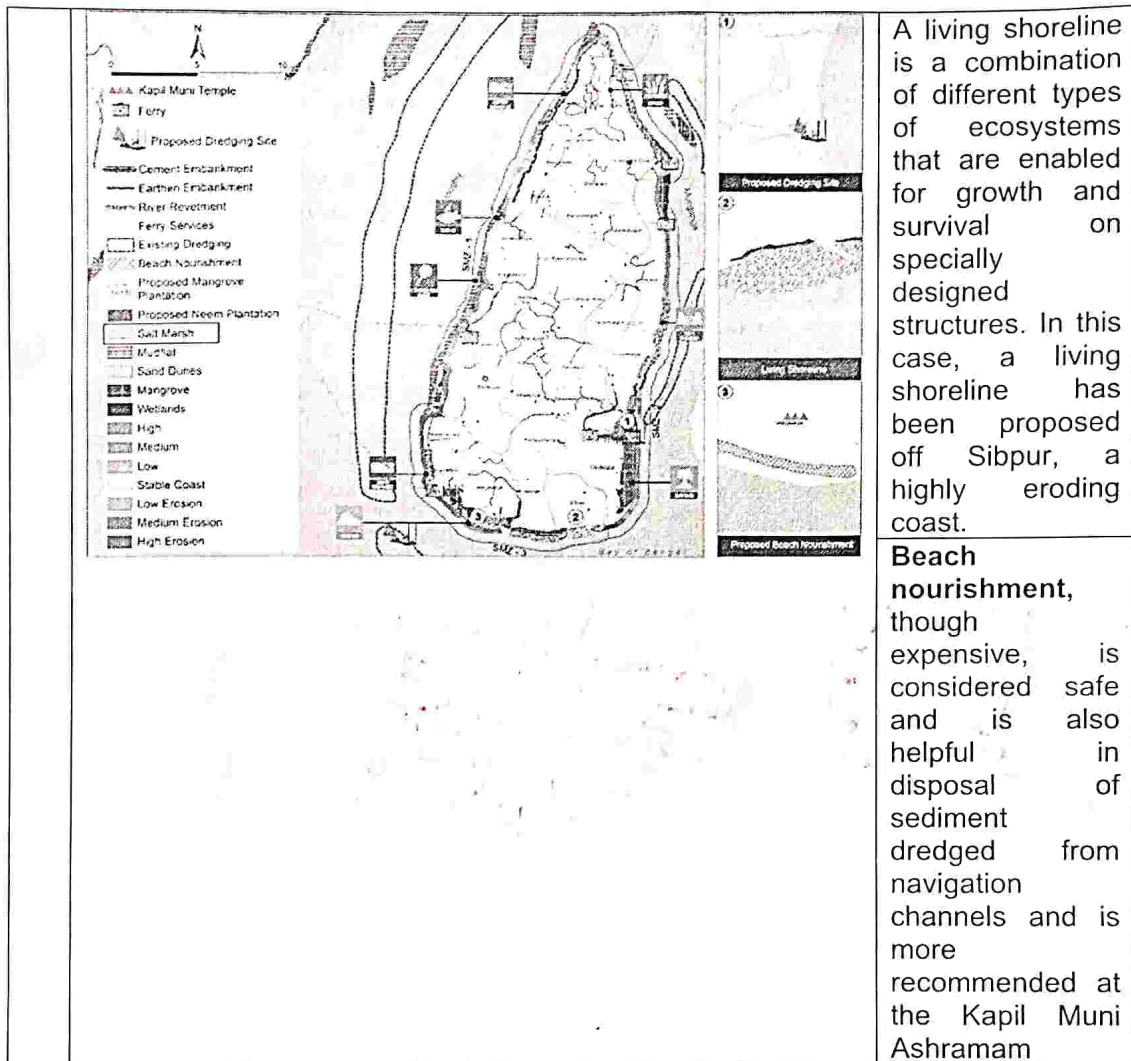


identified as a focal point for beach nourishment using dredged materials. Details are provided in the Table 1.

Table 1: erosion control measures along the Sagar Island and Kapil Muni Ashramam

		Details
Existing		<p>Sagar Island is encircled by embankments, mostly earthen, a few cemented. The island is undergoing extensive erosion in patches. Approachable only through the sea route and surrounded by shipping lanes, dredging activities are also being carried out.</p>
Proposed		<p>Dredging of channels is required to enable proper navigation as well as free exchange of water.</p>





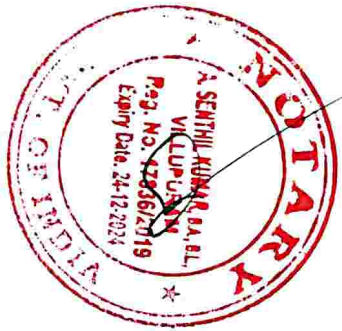
Key recommendations provided under the shoreline management plan and are listed below:

- **Implementation of living shoreline** at the eroding sites (Sibpur) to stabilize the coast and safeguard life and property of the coastal community
- Improving biological productivity by implementing the living coastline structure that would naturally encourage ecological diversity
- Accumulation of sediments through mangrove plantation behind the offshore reef and at specific sites along Sagar Island.
- Especially at Kapil Muni Ashramam, implementing **periodic beach nourishment with dredged material** is strongly recommended. This proactive measure not only helps to save the beach but also mitigates continuous erosion. Moreover, it



plays a crucial role in maintaining the aesthetic appeal of the beach region. Additionally, in light of rising sea levels due to climate change, such initiatives are vital for protecting coastal areas. Therefore, integrating regular beach nourishment practices is essential for safeguarding the natural beauty and resilience of Kapil Muni Ashramam and its surrounding areas.

For more detailed information, bathymetry, land use, and other relevant data, the ICZM plan of Sagar Island submitted to SPMU of the Integrated Coastal Zone Management Project (ICSMP) phase-1, West Bengal, may be consulted.



*[Handwritten Signature]*  
A. SENTHIL KUMAR, B.A., LL.B.  
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19/08/2024

VAKALATNAMA

BEFORE THE NATIONAL GREEN TRIBUNAL, KOLKATA/EZ

O.A. No. 70 of 2024

News Item titled "Rising sea, shrinking sands erode vibrancy of Ganga Sagar Mela" appearing in the Hindu dated 15.01.2024

Plaintiff  
Petitioners

-Versus-

West Bengal State Coastal Zone Management Authority & Ors.

Defendant  
Opposite Party

On behalf of NCSCN(R-2)

Know all men by these presents that by Vakalatnama I/We appoint the Advocates noted below or any of them my/our lawful Advocate or Advocates for filing the Memorandum of appeal or petition in the for entering Appearance above matter for appearing in conducting and arguing the same, for depositing or withdrawing any money in connection therewith for moving the Court in any matter connected therewith, for preparing the paper book in the case and for putting in papers petitions etc. on my/our behalf for filing taking back any documents for withdrawing suits or appeals or petitions with permission to institute fresh suits etc. For signing and filing petitions of compromise in connections with said matter and for taking copies of paper form the Record and I/We further say that any act, done by my/one said Advocate or Advocates or by any of them after accepting this Vakalatnama, shall be considered as my/our true and lawful act.

And I/we further hereby agree and undertake to pay the said Advocates his or their fees are settled and all others sums that may be necessary to carry out the requisition of the Court and otherwise to enable the said Advocates to conduct property. Failing which the said Advocates after notice to me/us will be liberty to withdraw form the further conduct to the case.

IN WITNESS WHERE OF I/We sign and execute this Vakalatnama on this the 30th day on August 2024

*Vakalatnama received  
and accepted*

*Ashok Prasad*

NAME OF ADVOCATES  
ASHOK PRASAD, ADVOCATE

*S. Purraj*  
20/8/2024

Director  
National Centre for Sustainable Coastal Management  
Ministry of Environment, Forest and Climate Change  
Government of India, Anna University Campus  
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